electrodes, and (b) an image-forming member for forming an image under irradiation of electrons emitted from the electron source, the method comprising the steps of:

forming said plurality of electron-emitting devices by a process including the steps of:

F2 cont.

preparing a plurality of electroconductive films; and

energizing said electroconductive films, while heating a substrate on which said electroconductive films are disposed within a predetermined atmosphere comprising a gas for promoting cohesion of the electroconductive films, wherein, after the start of the energizing and the heating, the predetermined atmosphere including the gas for promoting the cohesion of the electroconductive films is formed.

REMARKS

Claims 1-5, 7-34, 36-38 and 40-47 remain pending in this application. Claims 18 and 31 have been amended.[1]

Claims 1, 2, 14-18, 30, and 31 are independent claims.

In the Office Action, Claims 31 was rejected under 35 U.S.C. § 112, second paragraph, as indefinite, and also was rejected under 35 U.S.C. § 112, first paragraph, as not being supported by an enabling disclosure.

Claim 31 has been amended to change "stored" to "formed" in that claim,

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1/ The amendment to Claim 18 corrects a typographical error, and is not believed to affect the scope of that claim.

to further ensure that Claim 31 complies fully with the requirements of Section 112, first and second paragraphs. Accordingly, it is believed that the Section 112 rejections have been obviated, and their withdrawal is therefore respectfully requested.

Claims 1-8, 11-17, 20-24, 27-29, 31, 33, 34, 36-38, 40, 41, and 44-47 were rejected under 35 U.S.C. § 103(a) as being unpatentable over either U.S. Patent 6,034,478 (Kawade et al.) or Japanese Patent Application No. Hei 09-298029 (JP09-298029) in view of Japanese Patent Laid Open No. 64-19658 (Banno et al.). Claims 9-12, 25, 26, 42, and 43 were rejected under 35 U.S.C. § 103(a) as being unpatentable over either Kawade et al. or JP09-298029 in view of Banno et al., and further in view of European Patent Application EP 0 769 796 A1 (Taiko et al.), Claims 1-8, 11-24, 27-41, and 44-46 were rejected under 35 U.S.C. § 103(a) as being unpatentable over either Kawade et al. or JP09-298029 in view of Banno et al., and further in view of Japanese Patent Laid Open No. 6-12997 (Ueno et al.), and Claims 9-12, 25, 26, 42, and 43 were rejected under 35 U.S.C. § 103(a) as being unpatentable over either Kawade et al. or JP09-298029 in view of Banno et al. and Ueno et al., and further in view of Taiko et al.

Initially, the Examiner is sincerely thanked for pointing out the typographical error contained on page 14, the last line, of the Amendment And Petition For Extension Of Time filed on November 20, 2001. The word "increases" should have read "decreases", as suggested in paragraph 11 of the present Office Action. Applicants' attorney apologizes for any inconvenience which the typographical error may have caused the Examiner, and notes that the error was inadvertent.

With regard to the art rejections set forth in the Office Action, Applicants respectfully offer the following comments.

According to an aspect of the present invention, an electroconductive film is subjected to heating and energizing within a predetermined atmosphere comprising a gas for promoting cohesion of the electroconductive film. With regard to the energizing of the electroconductive film within the predetermined atmosphere, a temperature increases locally at a part of the electroconductive film, and the cohesion progresses locally preferably at a part where there is increased temperature, rather than at portions at a periphery thereof, thereby forming an electron-emitting region, and more particularly, a fissure in the electroconductive film, using relatively low electric power (this is referred to hereinafter as "situation (1)").

With regard to heating of a substrate at a time of energizing the electroconductive film within the predetermined atmosphere, even at a thinner portion of the electroconductive film (which portion has a tendency wherein the temperature increases less than it does at another portion), the temperature rapidly increases and reaches a level at which the cohesion progresses at a high speed satisfactorily, to perform the cohesion at a satisfactory rate. As a result, even at such a thin portion of the electroconductive film, the electron-emitting region can be formed (this is referred to hereinafter as "situation (2)").

According to an aspect of the present invention to which Claims 1 and 14-17 relate, in the heating and energizing of the electroconductive film within the predetermined atmosphere, the heating temperature is controlled. According to an aspect of the invention to which Claims 18, 30, and 31 relate, timings of both the heating and

energizing, and the forming of the predetermined atmosphere comprising the gas for promoting cohesion, are controlled. As a result of these aspects of the invention, electron-emitting devices with improved characteristics are produced, and the reproducibility of the characteristics is improved.

The recitations of independent Claims 1, 2, and 18 will now be discussed.

Independent Claim 1 is directed to a method for producing an electron-emitting device including a pair of electrodes and an electroconductive film having an electron-emitting region. The film is disposed between the pair of electrodes, and the electron-emitting region is formed by the steps of heating, at a temperature not higher than 150°C, a substrate on which an electroconductive film is disposed, and energizing the electroconductive film. The steps of heating and energizing are conducted within an atmosphere comprising a gas for promoting cohesion of the electroconductive film.

Independent Claim 2 is directed to a method for producing an electron-emitting device including a pair of electrodes and an electroconductive film having an electron-emitting region. The film is disposed between the pair of electrodes. The electron-emitting region is formed by the steps of preparing an electroconductive film, and energizing the electroconductive film while heating a substrate on which the film is disposed at a temperature not higher than 150°C, within an atmosphere comprising a gas for promoting cohesion of the electroconductive film.

Independent Claim 18 is directed to a method for producing an electron-emitting device including a pair of electrodes and an electroconductive film having an electron-emitting region. The film is disposed between the pair of electrodes, and the

region is formed by a process of preparing an electroconductive film, and energizing the electroconductive film while heating a substrate on which the electroconductive film is disposed, within a predetermined atmosphere comprising a gas for promoting cohesion of the electroconductive film, wherein, after the start of the energizing and the heating, the predetermined atmosphere including the gas for promoting cohesion of the electroconductive film is formed.

As pointed out in the Amendment And Petition For Extension Of Time filed on November 21, 2001, Kawade et al. and Japanese Patent Application No. Hei 09-298029 refer to an electroconductive film that is subjected to energization within an atmosphere for promoting cohesion of the electroconductive film. As a pulse voltage is applied between device electrodes to cause electric current to flow through the electroconductive film, heat is thermally generated in the film itself as a result of that energization of the film. The Office Action cites those references as teaching "energization forming an electroconductive film in an atmosphere comprising a gas that promotes the cohesion of the electroconductive film while heating the film by resistance."

Banno et al. refers to an electroconductive film being heated by a heater 25 while the film is being energized (Fig. 2). The complete electroconductive film is heated by the heater 25 to prevent a breakage in a substrate caused by localized heating during the energizing of the electroconductive film (see, e.g., page 3, last line through page 4, line 1, and page 4, lines 13-18 in the English translation of Banno et al., of record).

Ueno et al. relates to a surface-conduction type of electron emitting device in which a position and shape of an electron emission portion are controlled, and is cited in

the Office action as teaching "that using a flowing reducing atmosphere of H_2 gas of [5] SCCM in a vacuum, energization time can be reduced from one minute to 100 msec."

However, Applicants respectfully submit that nothing in Kawade et al., JP09-298029, Banno et al., and Ueno et al., would teach or suggest forming an electron-emitting region by a process comprising the steps of heating, at a temperature not higher than 150°C, a substrate on which an electroconductive film is disposed, and energizing the electroconductive film, as recited in Claim 1. Neither would anything in those references teach or suggest forming an electron-emitting region by a process including energizing an electroconductive film while heating a substrate on which the electroconductive film is disposed at a temperature not higher than 150°C within an atmosphere comprising a gas for promoting cohesion of the electroconductive film, as recited in Claim 2.

With regard to Claim 18, according to an aspect of the invention to which that claim relates, controlling of timings is performed such that, after the start of heating and energizing, the predetermined atmosphere including the gas for promoting cohesion of the electroconductive film is formed. Applicants respectfully note that those steps are *not* performed to reduce any so-called "waste of gas" referred to by the Examiner.

Cohesion of an electroconductive film within an atmosphere including the gas can progress even without energizing the electroconductive film, and the speed at which the cohesion of the electroconductive film progresses can be made greater abruptly as the heating temperature of the substrate increases. For example, referring to page 65 of the specification, and comparing the cohesion under temperature 100°C (Example 2) with the cohesion under room temperature 25°C (Reference Example 1), even without

energization of the electroconductive film, within a predetermined atmosphere containing the cohesion promoting gas, the latter case (25°C) requires about one hour for reducing the resistance value by the cohesion with the reduction, while the former case (100°C) requires only *several seconds*.

Under a condition of heating the substrate, when an atmosphere containing a gas for promoting cohesion of the electroconductive film is introduced, the cohesion of the whole of the electroconductive film starts, even prior to the energization of the electroconductive film. In this case, situation (1) described above would hardly be realized, and it would be difficult to form an electron-emitting region reproducibly and control the overall producing process. For this reason, it is important to control a relationship between the timing of heating and the time at which the cohesion-promoting gas is introduced, as is done in the method recited in Claim 18. In Applicants' view, neither Kawade et al., JP09-298029, Banno et al., nor Ueno et al. discloses or suggests such important timings, and in particular, a process of forming an electron-emitting region by energizing an electroconductive film while heating a substrate on which the electroconductive film is disposed within a predetermined atmosphere comprising a gas for promoting cohesion of the electroconductive film, wherein after the start of the energizing and heating, the predetermined atmosphere including the gas for promoting the cohesion of the electroconductive film is formed, as recited in Claim 18.

In the remarks supporting at least one of the Section 103 rejections set forth in the Office Action, it is asserted that "it would have been known to one of ordinary skill in the art that the process of Kawade is desirably carried out after first preheating the

substrate to avoid cracking due to thermal shock[,] . . . [and] because the process of Kawade et al would produce undesirable cracking of the substrate if there were no preheating of the substrate" (paragraph 6 of the Office Action). However, in Applicants' view, while Banno et al. may teach that the heating of a substrate provides an advantage of preventing substrate cracking due to local heating caused by energizing the electroconductive film, and even if Ueno et al. be deemed to teach that energizing an electroconductive film within an atmosphere comprising a gas (such as H_2 or the like) for promoting cohesion provides an advantage of reducing an energizing time, Applicants submit that neither Kawade et al., JP09-298029, Banno et al., nor Ueno et al. teaches, suggests, or recognizes a need to address problems (or their cause) which can degrade characteristics of an electron-emitting device and their reproducibility, encountered in cases where a process of heating *and* energizing an electroconductive film within a cohesion-promoting gas is used (see, e.g., page 21, lines 3-10 of the present application), especially since Applicants understand those problems and their causes may have been unknown conventionally; nor do those references provide a technique which solves those problems, such as through the precise control of a heating temperature.

Moreover, even if Banno et al. be deemed to teach that, when a heating temperature is set higher, nearly at a temperature of a locally heated portion on a substrate, a frequency of cracking in the substrate can be reduced, Applicants note and recognized that when heating of an electroconductive film is performed at such a high temperature within a cohesion-promoting atmosphere, the temperature of the *whole* electroconductive film increases. As a result, cohesion progresses substantially instantaneously for the whole

electroconductive film. In this case it would be difficult to form an electron-emitting region through energizing (forming a fissure in the electroconductive film). According to Applicants' invention, however, situation (1) avoids this problem.

Since neither Kawade et al., JP09-298029, Banno et al., nor Ueno et al. is seen to be concerned with the above problems, Applicants submit that one skilled in the art, who was faced with the same problems confronted by Applicants at the time of their invention, would not have consulted those references or been motivated to combined them in the manner proposed in the Office Action. Indeed, the Examiner's suggestion to combine those references seemingly constitutes improper hindsight reasoning, since it proposes to combine references to achieve a result (i.e., Applicants' solution to the above-described problems) apparently gleaned solely from Applicants' disclosure, without any teaching, suggestion, or motivation in the prior art to do so. MPEP § 2142 (it is impermissible to resort to hindsight based on an applicant's disclosure; a legal conclusion of obviousness must be based on facts gleaned from the prior art).[2]

For all of the foregoing reasons, Applicants respectfully submit that it would not have been obvious to one skilled in the art at the time of Applicants' invention, to combine either Kawade et al. or JP09-298029 with Banno et al., or Kawade et al. or

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2/ Applicants also disagree with the statements set forth in paragraph 12 of the Office Action. The Amendment And Petition For Extension Of Time filed on November 20, 2001 did *not* assert that Banno et al. and Ueno et al. are "not concerned with the problems faced by [*Kawade et al.*]", as alleged in paragraph 12 of the Office Action. Instead, the Amendment asserted that the references (Banno et al., Ueno et al., Kawade et al., and JP09-298029) relied on in the Office Action of July 20, 2001 to reject the then pending Claims 1, 2, and 18 are not concerned with a need to solve the problems (described on pages 14 and 15 of that Amendment) faced by *Applicants* at the time of their invention.

JP09-298029 with Banno et al. and Ueno, in the manner proposed in the Office Action, in an attempt to provide the methods recited in Claims 1, 2, and 18.

Accordingly, Claims 1, 2, and 18 each are deemed clearly patentable over those references.

Independent Claims 14 and 15 are directed to a method for producing an electron source and a method for producing an image-forming apparatus, respectively, and each recite features that are similar in many relevant respects to those of Claim 1 discussed above relating to heating a substrate at a temperature of not higher than 100°, and also are believed to be patentable over the art relied on in the Office Action for the same reasons as is Claim 1.

Independent Claims 16 and 17 are directed to a method for producing an electron source and a method for producing an image-forming apparatus, respectively, and each recite features that are similar in many relevant respects to those of Claim 2 discussed above relating to heating a substrate at a temperature of not higher than 150°, and also are believed to be patentable over the art relied on in the Office Action for the same reasons as is Claim 2.

Independent Claims 30 and 31 are directed to a method for producing an electron source and a method for producing an image-forming apparatus, respectively, and each recite features that are similar in many relevant respects to those of Claim 18 discussed above relating to forming a predetermined atmosphere including a gas for promoting cohesion of an electroconductive film, after the start of energizing and heating,

and also are believed to be patentable over the art relied on by the Examiner for the same reasons as is Claim 18.

A review of the other art of record has failed to reveal anything which, in Applicants' opinion, would remedy the deficiencies of the art discussed above, as references against the independent claims herein. Those claims are therefore believed patentable over the art of record.

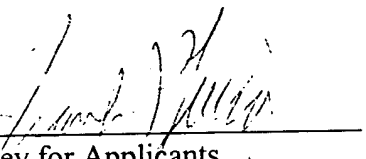
The other claims in this application are each dependent from one or another of the independent claims discussed above and are therefore believed patentable for the same reasons. Since each dependent claim is also deemed to define an additional aspect of the invention, however, the individual reconsideration of each on its own merits is respectfully requested.

This Amendment After Final Rejection is believed clearly to place this application in condition for allowance and its entry is therefore believed proper under 37 C.F.R. § 1.116. The amendments to Claims 18 and 31 are believed to be merely formal in nature, and are believed to not affect the scope of those claims. In any event, entry of this Amendment After Final Rejection, as an earnest effort to advance prosecution and reduce the number of issues, is respectfully requested. Should the Examiner believe that issues remain outstanding, the Examiner is respectfully requested to contact Applicants' undersigned attorney in an effort to resolve such issues and advance the case to issue.

In view of the foregoing amendments and remarks, Applicants respectfully request favorable reconsideration and early passage to issue of the present application.

Applicants' undersigned attorney may be reached in our New York office by telephone at (212) 218-2100. All correspondence should continue to be directed to our below listed address.

Respectfully submitted,



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VERSION WITH MARKINGS SHOWING CHANGES MADE TO CLAIMS

18. (Twice Amended) A method for producing an electron-emitting device including a pair of electrodes and an electroconductive film having an electron-emitting region, said electroconductive film being disposed between the pair of electrodes, wherein said electron-emitting region is formed by a process of:

preparing [an the] <u>said</u> electroconductive film; and

energizing said electroconductive film while heating a substrate on which said electroconductive film is disposed within a predetermined atmosphere comprising a gas for promoting cohesion of the electroconductive film, wherein, after the start of the energizing and the heating, the predetermined atmosphere including the gas for promoting the cohesion of the electroconductive film is formed.

31. (Twice Amended) A method for producing an image-forming apparatus comprising (a) an electron source comprising a plurality of electron-emitting devices, each including a pair of electrodes and an electroconductive film having an electron-emitting region, said electroconductive film being disposed between the pair of electrodes, and (b) an image-forming member for forming an image under irradiation of electrons emitted from the electron source, the method comprising the steps of:

forming said plurality of electron-emitting devices by a process including the steps of:

preparing a plurality of electroconductive films; and

energizing said electroconductive films, while heating a substrate on which said electroconductive films are disposed within a predetermined atmosphere comprising a gas for promoting cohesion of the electroconductive films, wherein, after the start of the energizing and the heating, the predetermined atmosphere including the gas for promoting the cohesion of the electroconductive films is [stored] formed.